Evaluating the Reduction of Stress Intensity Factor in Center-Cracked Plates Using Piezoelectric Actuators

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Abstract

Active repairs using smart materials such as piezoelectric actuators can play a significant role in reducing the crack damage propagation in engineering structures. This study analytically and numerically investigated the active repair of center-cracked plates using piezoelectric actuators. First, the stress intensity factor (SIF) for a center-cracked plate due to stress produced by a piezoelectric actuator is analytically modeled. This analytical model is obtained by applying the method of weight functions. In the second step, the solution is found for the center-cracked plate due to external loading from known linear elastic fracture mechanics. These solutions are then superimposed, taking into account the superposition principle to yield the total stress intensity factor for the integrated piezoelectric actuator to the center-cracked plate. Finally, the proposed theoretical model is verified by finite element simulation. The results indicated that the relative errors of the analytical model and the FEA results are less than 5% in all the cases studied in this paper.

Keywords

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KeyWords Plus: ACTIVE REPAIR; FRACTURE-MECHANICS; PATCHES; BEAM; LOAD

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